

National and Global Energy Resources

Question Paper 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Physics
Exam Board	AQA
Topic	6.1 Energy
Sub-Topic	National and Global Energy Resources
Difficulty Level	Gold Level
Booklet	Question Paper 1

Time Allowed: 55 minutes

Score: /54

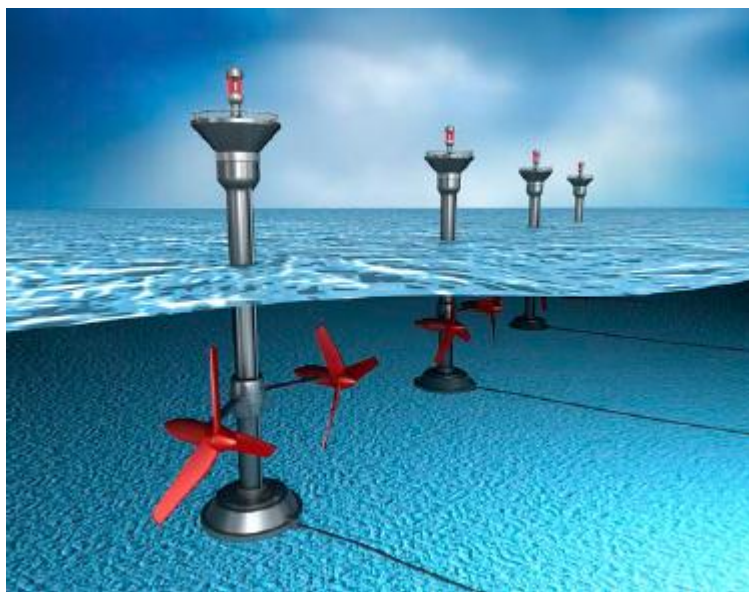
Percentage: /100

Grade Boundaries:

Q1.Electricity in the UK is generated in many ways.

The figure below shows an undersea turbine.

The undersea turbine uses tidal energy to generate electricity.



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(a) What is the original source of energy for tidal power schemes?

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(1)

(b) Explain **two** advantages of using undersea tidal turbines to generate electricity rather than burning fossil fuels.

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(4)

- A hectare of agricultural land can produce 9 tonnes of dry willow wood per year.

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(3)

- | Fuel | Direct CO ₂ emissions
in kg per MWh | Lifecycle CO ₂
emissions
in kg per MWh |
|-------------|---|---|
| Coal | 460 | 540 |
| Natural gas | 185 | 215 |
| Oil | 264 | 313 |
| Wood | 2 100 | 58 |

Page 3

Use the data from the table above to explain why wood is considered to be a low carbon dioxide emitting fuel.

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(2)
(Total 10 marks)

Q2. Solar panels are often seen on the roofs of houses.

- (a) Describe the action and purpose of a solar panel.

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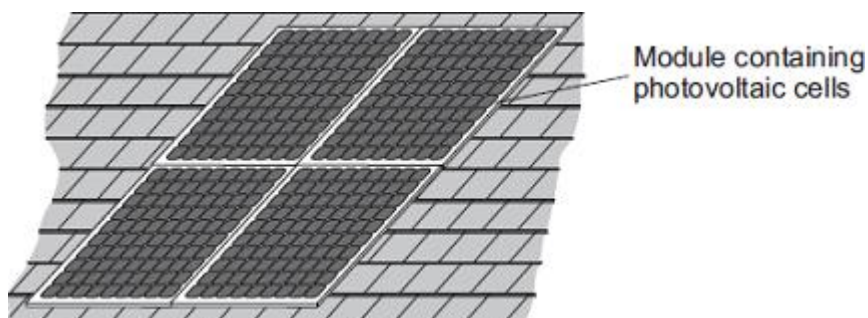
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(2)

- (b) Photovoltaic cells transfer light energy to electrical energy.

In the UK, some householders have fitted modules containing photovoltaic cells on the roofs of their houses.

Four modules are shown in the diagram.



The electricity company pays the householder for the energy transferred.

The maximum power available from the photovoltaic cells shown in the diagram is $1.4 \times 10^3 \text{ W}$.

How long, in minutes, does it take to transfer 168 kJ of energy?

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..... Time = minutes

(3)

- (c) When the modules are fitted on a roof, the householder gets an extra electricity meter to measure the amount of energy transferred by the photovoltaic cells.
- (i) The diagram shows two readings of this electricity meter taken three months apart.
The readings are in kilowatt-hours (kWh).

21 November

0	0	0	4	4
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21 February

0	0	1	9	4
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Calculate the energy transferred by the photovoltaic cells during this time period.

.....

Energy transferred = kWh

(1)

- (ii) The electricity company pays 40p for each kWh of energy transferred.
Calculate the money the electricity company would pay the householder.

.....

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Money paid =

(2)

- (iii) The cost of the four modules is £6000.

Calculate the payback time in years for the modules.

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Payback time = years

(3)

- (iv) State an assumption you have made in your calculation in part (iii).

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(1)

- (d) In the northern hemisphere, the modules should always face south for the maximum transfer of energy.

State **one** other factor that would affect the amount of energy transferred during daylight hours.

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(1)

(Total 13 marks)

- Q3.(a)** In the UK, over 70% of the electricity is generated in power stations that burn fossil fuels.

- (i) Explain **one** effect that burning fossil fuels has on the environment.

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(2)

- (ii) Give **one** way the effect on the environment described in part (a)(i) could be reduced.

Assume the amount of fossil fuels burnt stays the same.

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(1)

- (b) Electricity can also be generated in a pumped storage hydroelectric power station.

An advantage of pumped storage hydroelectric power stations is the short start-up time they have.

- (i) What is the importance of the short start-up time?

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.....

(1)

- (ii) Give **one** other advantage of a pumped storage hydroelectric power station.

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(1)

- (c) Read the extract below from a newspaper article.

In the future it may not be possible to have constant electricity. Families will have to get used to using power when it is available.

- (i) In the UK, the proportion of electricity generated using wind turbines is due to increase a lot. Some opponents of wind turbines think this increase will cause

big fluctuations in the electricity supply.

Suggest **one** reason why this may be true.

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(1)

- (ii) Between 2002 and 2008 the amount of electricity used for lighting in homes in the UK decreased.

Suggest **one** reason why.

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(1)

(Total 7 marks)

Q4. About half of the UK's electricity is generated in coal-burning power stations and nuclear power stations.

- (a) Coal-burning power stations and nuclear power stations provide a reliable way of generating electricity.

What is meant by a *reliable way of generating electricity*?

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.....

(1)

- (b) Over the next few years, most of the older nuclear power stations in the UK will be closed down, and the process of decommissioning will start.

What does it mean to *decommission* a nuclear power station?

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(1)

- (c) Climate change has been strongly linked to the emission of carbon dioxide. Many governments around the world are committed to reducing carbon dioxide emissions.

Generating electricity can increase carbon dioxide emissions.

The companies generating electricity could reduce carbon dioxide emissions.

Give **two** ways the companies could do this.

1

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2

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(2)

- (d) Electricity is distributed from power stations to consumers along the National Grid.

The voltage across the overhead cables of the National Grid needs to be much higher than the output voltage from the power station generators.

Explain why.

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(3)

(Total 7 marks)

Q5.(a) Solar energy is a *renewable* energy source used to generate electricity.

- (i) What is meant by an energy source being *renewable*?

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(1)

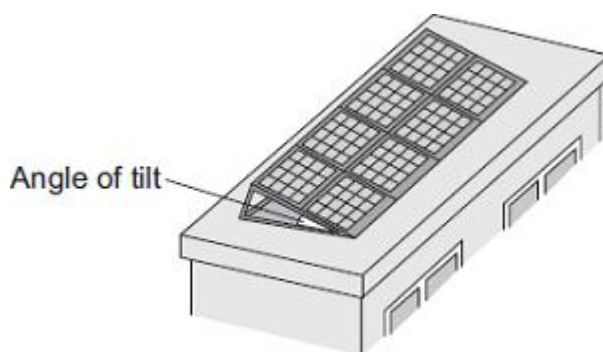
(ii) Name **two** other renewable energy sources used to generate electricity.

1

2

(1)

(b) A householder uses panels of solar cells to generate electricity for his home. The solar cells are tilted to receive the maximum energy input from the Sun.



The data in the table gives the average energy input each second (in J/s), to a 1 m² area of solar cells for different angles of tilt and different months of the year.

Month	Angle of tilt			
	20°	30°	40°	50°
February	460	500	480	440
April	600	620	610	600
June	710	720	680	640
August	640	660	640	580
October	480	520	500	460
December	400	440	420	410

(i) Use the data in the table to describe how the average energy input to the solar cells depends on the angle of tilt.

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(2)

- (ii) The total area of the solar cell panels used by the householder is 5 m^2 .

The efficiency of the solar cells is 0.18.

Calculate the average **maximum** electrical energy available from the solar cell panels each second in June.

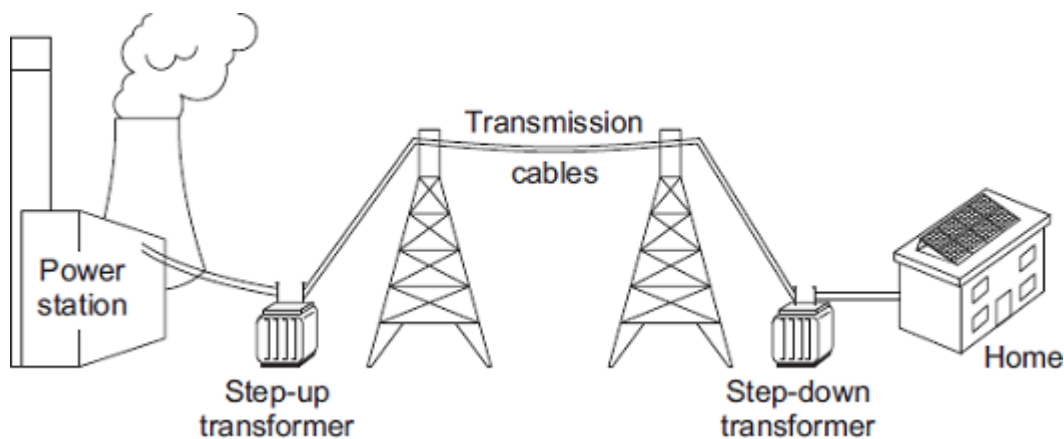
Show clearly how you work out your answer.

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Maximum energy = joules/second

(3)

- (c) The diagram shows part of the National Grid.



- (i) Even though the householder uses solar cells to generate electricity for his home, the home stays connected to the National Grid.

Give **one** reason why the householder should stay connected to the National Grid.

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(1)

- (ii) The step-up transformer increases the efficiency of the National Grid.

Explain how.

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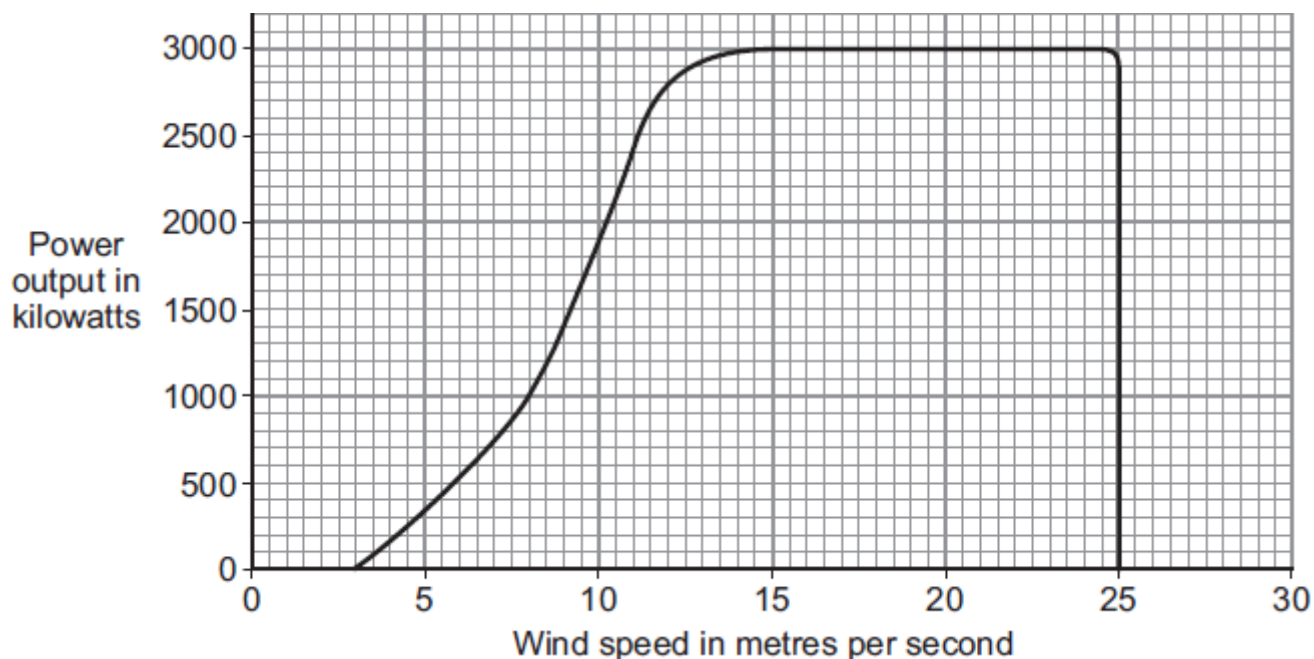
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(2)
(Total 10 marks)

Q6. The world's biggest offshore wind farm, built off the Kent coast, started generating electricity in September 2010.

- (a) The graph shows how wind speed affects the power output from one of the wind turbines.



In one 4-hour period, the wind turbine transfers 5600 kilowatt-hours of electrical energy.

Use the data in the graph to calculate the average wind speed during this 4-hour period.

Show clearly how you work out your answer.

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Average wind speed = m/s

(3)

(b) The wind turbines are linked to the National Grid by underwater cables.

(i) What is the National Grid?

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(1)

(ii) How is the National Grid designed to reduce energy losses during transmission?

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(1)

(c) Read this extract from a newspaper.

Power crisis as island basks in sunshine

The population of a small island off the coast of Scotland decided to generate all their electricity from water and wind. However, they did not predict having a long period of warm, dry weather. A combination of low water levels and hardly any wind has drastically reduced the output from the hydroelectric power station and wind turbines.

Explain **one** way in which the islanders could try to ensure that a similar power crisis

does **not** happen in the future.

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(2)
(Total 7 marks)